

## Electric IR Oven Improves Drying and Curing Silk Screen Inks

### The Challenge: Reduce Floor Space Requirements and Increase Production

The Cleveland Cooking Products Division of Maytag in Cleveland, Tennessee manufactures several styles of kitchen ranges. Each unit requires a control panel that allows the user to adjust the burners, set the oven temperature, and control the clock/timer. Depending upon the style of range, the control panels are either painted or porcelain enameled in one of four colors prior to the application of decals and/or silk-screen printing of the control markings.

Jeff Sellins, Manager of Finishing Engineering for the facility, was interested in reducing the floor space requirements and improving the overall productivity of the process.

### The Conventional Method

Maytag utilized a 1.1 million Btu gas infrared oven equipped with a flatbed conveyor for curing the silk screen inks and for pre-heating parts prior to applying the decals. The oven occupied an area 24 feet long by 8 feet wide (7.3 m × 2.4 m). The chain-link conveyor ran at 9 feet per minute (2.7 m/min).

Only one emitter temperature setting was possible at any given time in the gas IR oven which, due to the different energy absorption characteristics of various materials, caused non-uniform heating when different colors and finishes were being processed. In addition, the oven had several “hot spots” where the gas IR emitters were located, causing overheating of some areas of the parts. The total residence time of the parts in the oven was 2 minutes.

### The New Way

Several options were evaluated before deciding that an electric IR oven was the best alternative for preheating and curing



Examining decals applied to kitchen range control panels are (l-r) Ralph Gwaltney, Material Control Engineer, and Jeff Sellins, Manager of Finishing Engineering. Maytag is pleased with the consistent end product produced by their new small footprint electric IR oven, which is seen at the end of the product delivery track.

the parts. After running a series of tests in IR vendor laboratories to determine which type of electric IR would be best for the application and what size oven would be necessary, a new medium wavelength electric IR oven was selected to replace the old gas IR oven. The new oven is only 72 kW (245,000 Btu), occupies just 10 square feet (1 m<sup>2</sup>) of floor space (5 feet long by 2 feet wide (1.5 m × 0.6 m)), and employs an overhead conveyor. The line now runs at 10 feet per minute (3 m/min) and the control panels are hung three-high from the overhead conveyor.

The oven is equipped with three separately controlled heating zones. Each

zone is controlled by a photo-sensor that detects the presence of parts and turns the zone on or off as required. There are also optical pyrometers (heat sensors) for each zone that regulate power input and prevent overheating of individual parts. The new oven provides uniform heating, with no “hot spots”, and the three-zone feature now allows simultaneous processing of all colors and finishes.

### The Results

The new electric IR oven has increased productivity, provided a safer and cleaner workplace, drastically reduced floor space requirements, and reduced overall operating costs.

## Increased Productivity

With the line now running at 10 feet per minute (3 m/min) and control panels hung three-high from the overhead conveyor, an 11% increase in productivity has been attained. On the old line, parts were laid across on the flatbed conveyor, which ran at 9 feet per minute (2.7 m/min). About 540 parts per hour could be processed with that configuration. The new system has an overhead conveyor and three parts can be hung vertically on 36 inch (914 mm) centers. This new configuration allows Maytag to process 600 parts per hour and keep pace with assembly line requirements.

## A Safer, Cleaner, and Quieter Workplace

The use of electric IR has reduced the possibility of fires and provided a healthier workplace environment because no combustible materials, such as natural gas, are used in the process. There is also no need to ventilate the oven to exhaust products of combustion from the gas IR burners, which has eliminated the noise from exhaust fans.

## Space Savings

The new electric IR oven occupies only 5% of the space required for the old gas IR system (10 ft<sup>2</sup> versus 192 ft<sup>2</sup> (0.9 m<sup>2</sup> versus 17.2 m<sup>2</sup>)). It can easily be expanded if production requirements increase. The floor space that was gained is now being used for other production processes.

## Reduced Costs

Due to the high heat transfer efficiency of electric IR and the ability to more precisely focus the radiant energy, the new system requires only 72 kW, or 245,000 Btu, to accomplish the same task as the old 1.1 million Btu gas IR system. This has resulted in a net energy cost savings of 33% for the process.

## The Bottom Line

Electric IR heating and curing provides multiple benefits. The use of electric IR has allowed Maytag to improve productivity, reduce emissions, improve the environment of the workplace, and reduce overall costs. The reduction in emissions has improved air quality for both the community and the plant, and the increase in productivity will allow Maytag to meet their production requirements. The reduction in operating costs will improve overall profitability of the company.

## Assistance from Local Utility

With the assistance of Sara Madugula of the Tennessee Valley Authority (TVA), Maytag was able to identify a better pre-heating and curing process for the control panels that saved space and would enable them to meet their production requirements. Sara worked with the EPRI Center for Materials Fabrication (CMF) to identify a better pre-heating and curing process and arrange for testing in IR vendor laboratories. As a result, the medium wavelength electric IR oven was



**Jeff Sellins of Maytag, Dennis Daniel of Cleveland Utilities, and Sara Madugula of TVA worked as a team to help Maytag reach their goals of reducing floor space requirements and increasing production.**

installed and has allowed Maytag to meet its goals of reducing floor space requirements and increasing production.

## Other Applications for Electric IR Drying and Curing

Electric IR drying and curing is used extensively throughout the finishing industry on a wide variety of coated and printed products. Metal, wood, plastic, leather, and textile products can all be processed with electric IR. The technology is cleaner, safer, and quieter than gas heating technologies and, quite often, produces superior finishes. Many coatings and inks are now being specifically formulated for use with IR heating.

Photographs courtesy of Maytag Corp.


### Applicable SIC Codes:

344, 352, 354, 355, 356, 357, 363, 364, 371

To order additional copies of this publication call 800.313.3774 or e-mail [askepri@epri.com](mailto:askepri@epri.com).

© 1999 Electric Power Research Institute (EPRI), Inc.

All rights reserved. Electric Power Research Institute and EPRI are registered service marks of the Electric Power Research Institute, Inc. EPRI. POWERING PROGRESS is a service mark of the Electric Power Research Institute, Inc.

 Printed on recycled paper in the United States of America.

TA-113350

EPRI Center for Materials Fabrication • 929 Harrison Avenue, Suite 201 • Columbus, OH 43215  
614.421.3440 • [epri-cmf@infinet.com](mailto:epri-cmf@infinet.com)

EPRI Corporate address • 3412 Hillview Avenue, Palo Alto, CA 94304 • PO Box 10412, Palo Alto, CA 94303 USA  
800.313.3774 • 650.855.2121 • [askepri@epri.com](mailto:askepri@epri.com) • [www.epri.com](http://www.epri.com)